**EE 415 Digital Signal Processing**

**Credits:** 4

**Categorization of credits:** engineering topic

**Instructor(s):** Anders Høst-Madsen.

**Textbook and Other Required Materials:**

Sanjit K. Mitra: *Digital Signal Processing, A Computer Based Approach*, 3rd Edition, McGraw-Hill, 2006.

Lab Manual, available at: <http://highered.mcgraw-hill.com/sites/0072865466/>.

**Designation:** Elective

**Catalog Description:**

Discrete-time signals and systems, sampling, Z-transform, transform, transform analysis of linear time-invariant systems, filter design, discrete Fourier transform, and computation of discrete Fourier transform. Repeatable one time. Pre: 315 and 342 (or concurrent), or consent.

**Pre- and Co-requisites:** pre: 315 and 342 (or concurrent), or consent.

**Class/Lab Schedule:** 3 hour lecture/3 hour lab.

**Topics Covered:**

Varies somewhat by instructor. Currently covered:

* Discrete Time Signals and Systems (2h)
* Difference equations (2h)
* DTFT (1h)
* DFT (2h)
* Z-transform (5h)
* The transfer function (3h)
* Stability (1h)
* Sampling and A/D (2h)
* Filter structures (1h)
* Filter design (4h)
* Sampling rate alteration (2h)
* Polyphase decomposition (1h)
* Filter banks (4h)
* FFT (2h)
* Random signals (3h)

**Course Objectives and Relationship to Program Objectives:**

Students should be able to (i) understand and analyze DSP problems and (ii) design DSP algorithms to solve DSP problems [Program Objectives 1,2,3,4,5].

**Course Outcomes and Their Relationship to Program Outcomes**

The course outcomes are closely related to the topics covered

* Understand Discrete Time Signals and Systems [1].
* Understand DTFT, DFT and FFT and be able to analyze systems using these tools [1].
* Understand Z-transform and be able to analyze systems using this tools [1].
* Understand the influence of Sampling and A/D on DSP systems [1].
* Use system specifications to make decisions on filter design, and design filters using computer tools [1, 2, 6].
* Understand and design multirate DSP systems [1, 2, 6].
* Understand random signals [1].

**Contribution of Course to Meeting the Professional Component**

Engineering topics: 100%.

**Computer Usage:**

All labs and projects involve use of Matlab.

**Design Credits and Features:**

EE415 has 2 design credits. Most labs involve writing DSP programs in Matlab. In addition there is major design project, executed in several stages. The project used in past semesters is to design a sub-band codec for speech and music, similar to an MP3 coder.

**Person(s) Preparing Syllabus and Date:** Anders Høst-Madsen, 3/30/09; Y. Dong, June 14, 2021.